TPA3100D2 Audio Power Amplifier Evaluation Module With LC Filter

Contents

List of Figures

List of Tables

1 Introduction

1.1 Description

The TPA3100D2 evaluation module consists of a single 20-W, class-D, stereo audio power amplifier complete with a small number of external components mounted on a circuit board that can be used to directly drive a speaker with an external analog audio source as the input.

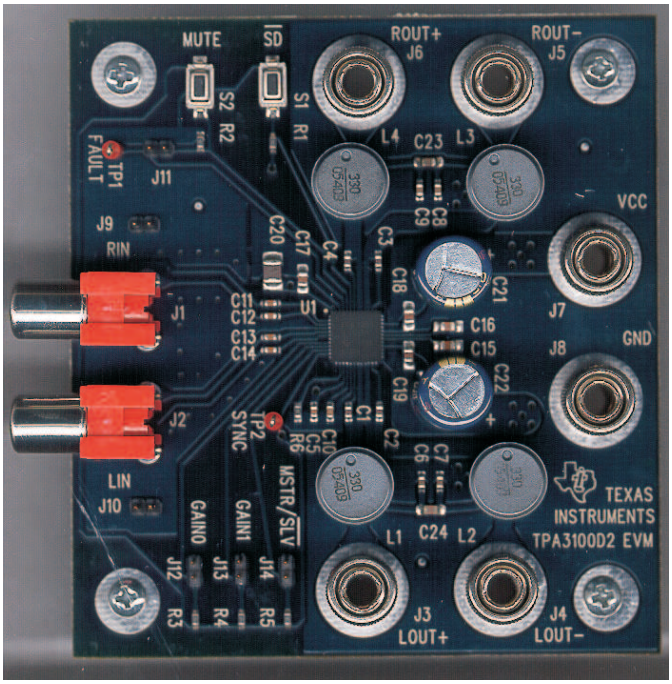

Figure 1. TI TPA3100D2 Audio Power Amplifier EVM – Top View

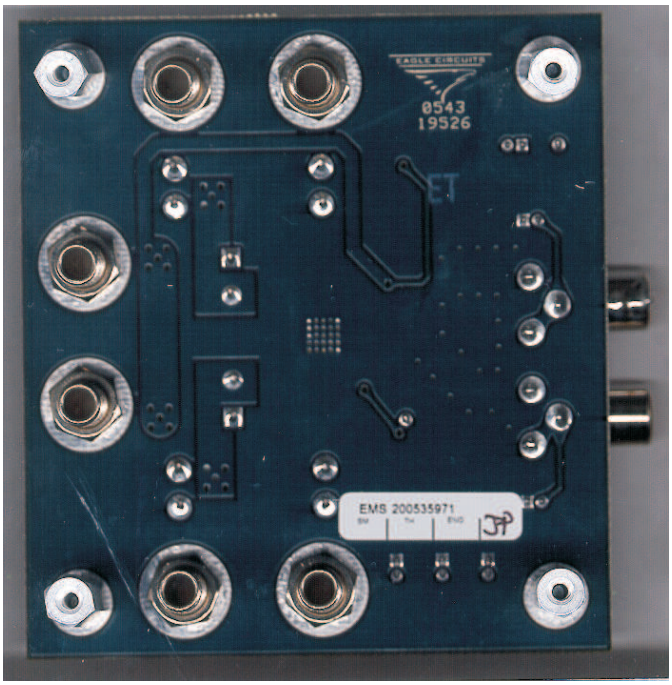

Figure 2. TI TPA3100D2 Audio Power Amplifier EVM – Bottom View

1.2 TPA3100D2 EVM Specifications

V_{CC}	Supply voltage range	10 V to 26 V
I_{CC}	Supply current	4 A max
P_O	Continuous output power per channel, 8 Ω, V_{CC} = 18 V, THD + N = 3.5%	20 W
R_L	Minimum load impedance	3.2 Ω

2 Operation

2.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the TPA3100D2 EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM module can be made using banana plugs for the power supply and output connections. The inputs accept standard RCA plugs.

2.1.1 Power Supply

1. Ensure that all external power sources are set to OFF.
2. Connect an external regulated power supply adjusted from 10 V – 26 V to the module V_{CC} (**J7**) and GND (**J8**) banana jacks taking care to observe marked polarity.

2.1.2 Evaluation Module Preparations

2.1.2.1 Inputs and Outputs

1. If connecting to a fully differential input or a grounded input (the shield of the RCA jack is GND), remove jumpers **J9** and **J10** from the EVM board. These are located next to the input jacks **J1** and **J2**. If connecting to a floating source, like a portable CD player, install **J9** and **J10**. After setting the **J9** and **J10** jumpers appropriately, connect the audio source to **J1** (RIGHT) and **J2** (LEFT).
2. Connect a speaker across ROUT+ (**J6**) and ROUT- (**J5**). Connect another speaker across LOUT+ (**J3**) and LOUT- (**J4**).
3. Install both gain jumpers GAIN0 (**J12**) and GAIN1 (**J13**). This sets the gain of the amplifier to the lowest level, 20 dB.
4. Remove the jumper at MSTR/$\overline{\text{SLV}}$ (**J14**). If only one TPA3100D2 is evaluated, it must be configured as the master. If multiple EVMs are connected together using the SYNC output (TP2), the additional EVMs must be configured in the slave mode by installing the **J14** jumper.
5. Remove the jumper (**J11**). This places the device in a latched mode when a short-circuit event occurs.

2.1.2.2 Control Inputs

1. **$\overline{\text{SD}}$:** This terminal is active low. A low signal on the device terminal (< 0.8 V) shuts down the amplifier; a high signal (> 2 V) on the device terminal places the amplifier in the active state. Holding down switch **S1** places the amplifier in the SHUTDOWN state. Releasing **S1** returns the amplifier to the active state.
2. **MUTE:** This terminal is active high. A high signal (> 2 V) on this terminal immediately terminates audio playback through the speakers and the outputs stop switching; a low signal (< 0.8 V) enables the device. **S2** on the EVM controls the state of the MUTE terminal. Holding down switch **S2** places the amplifier in the MUTE state. Releasing **S2** returns the amplifier to the active state.
3. **GAIN0/GAIN1:** Together, these terminals determine the gain of the amplifier. Refer to Table 1. Installing a jumper in **J12** or **J13** sets the respective terminal to GND. Removing the jumper sets the respective terminals to VREG (~4 V). Removing jumpers **INCREASES** the gain while installing jumpers **DECREASES** the gain. Logic levels are TTL compatible.
4. **MSTR/$\overline{\text{SLV}}$:** This terminal is used with the SYNC (**TP2**) output to synchronize the switching frequencies of multiple TPA3100D2 devices. For example, with 2 devices, one would be configured as the MASTER by removing the **J14** jumper. The other EVM would be configured as the SLAVE device by installing a jumper in the **J14** location. Logic levels are TTL compatible.

Table 1. Gain Settings

GAIN1 (J13)(1)	GAIN0 (J12)(1)	Amplifier Gain (dB)
ON	ON	20
ON	OFF	26
OFF	ON	32
OFF	OFF	36

(1) OFF = Jumper removed; ON = Jumper installed

2.1.2.3 Control Outputs

1. **FAULT:** This pin is a TTL compatible output for reporting a short-circuit fault on the output. If the outputs are shorted to GND, V_{CC}, or to each other, this terminal goes high and remains high until one of the following operations is performed: power is cycled, SHUTDOWN is cycled, or MUTE is cycled. If jumper **J11** is installed, the MUTE terminal is connected directly to the FAULT terminal and a short-circuit fault is automatically cleared when it occurs.

2.1.3 Power Up

1. Verify correct voltage and input polarity and turn the external power supplies on. The EVM should begin operation.
2. Adjust the input signal.
3. Adjust the control inputs to the desired settings.
4. If no sound is audible, check the position of the MSTR/$\overline{\text{SLV}}$ (**J14**) jumper. It should be removed if evaluating a single EVM.
5. Adjust the amplifier gain by installing/removing the gain jumpers, **J12** and **J13**.

3 TPA3100D2 EVM Schematic

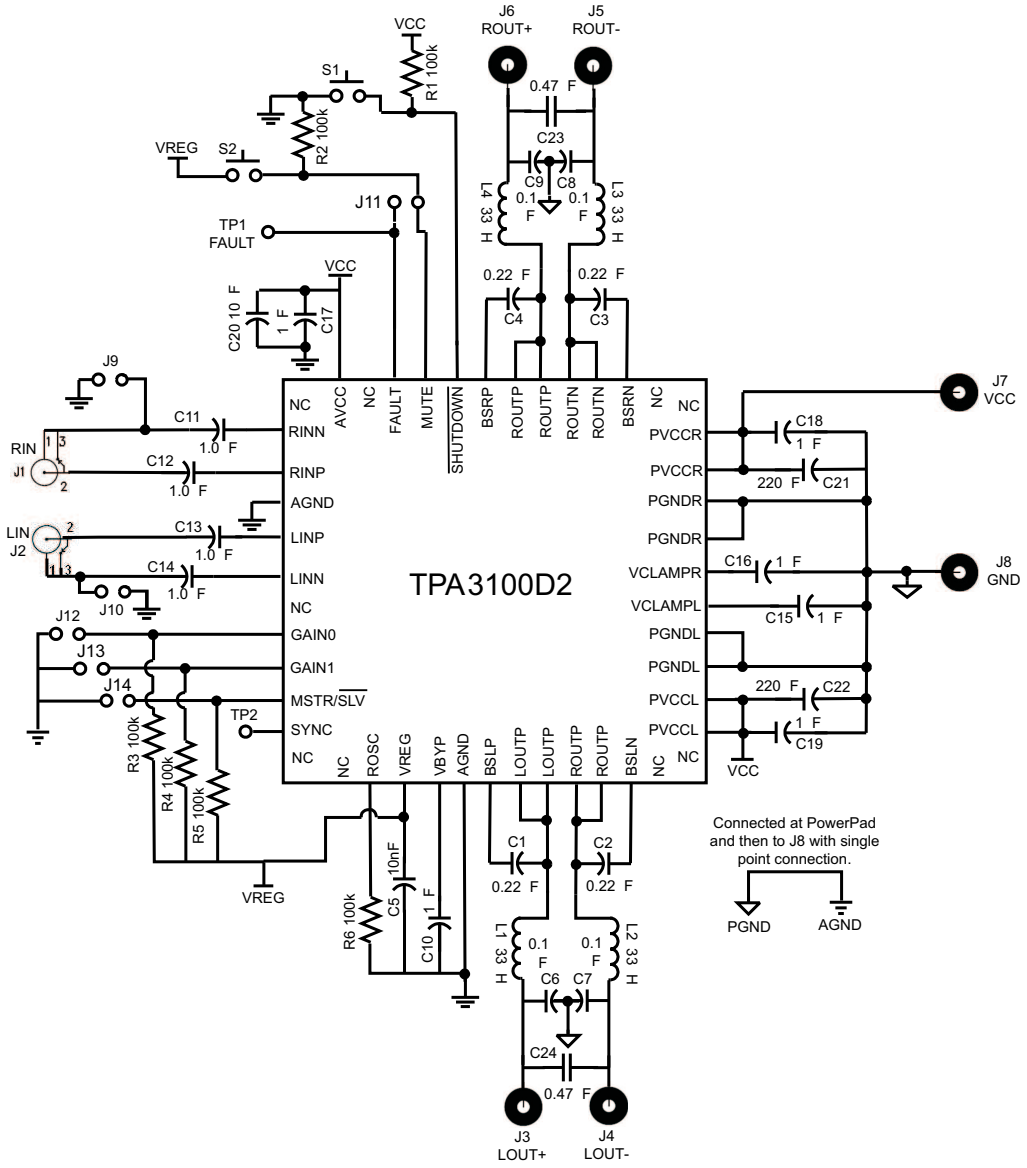

Figure 3. TPA3100D2 EVM Schematic

4 TPA3100D2 EVM PCB Layers

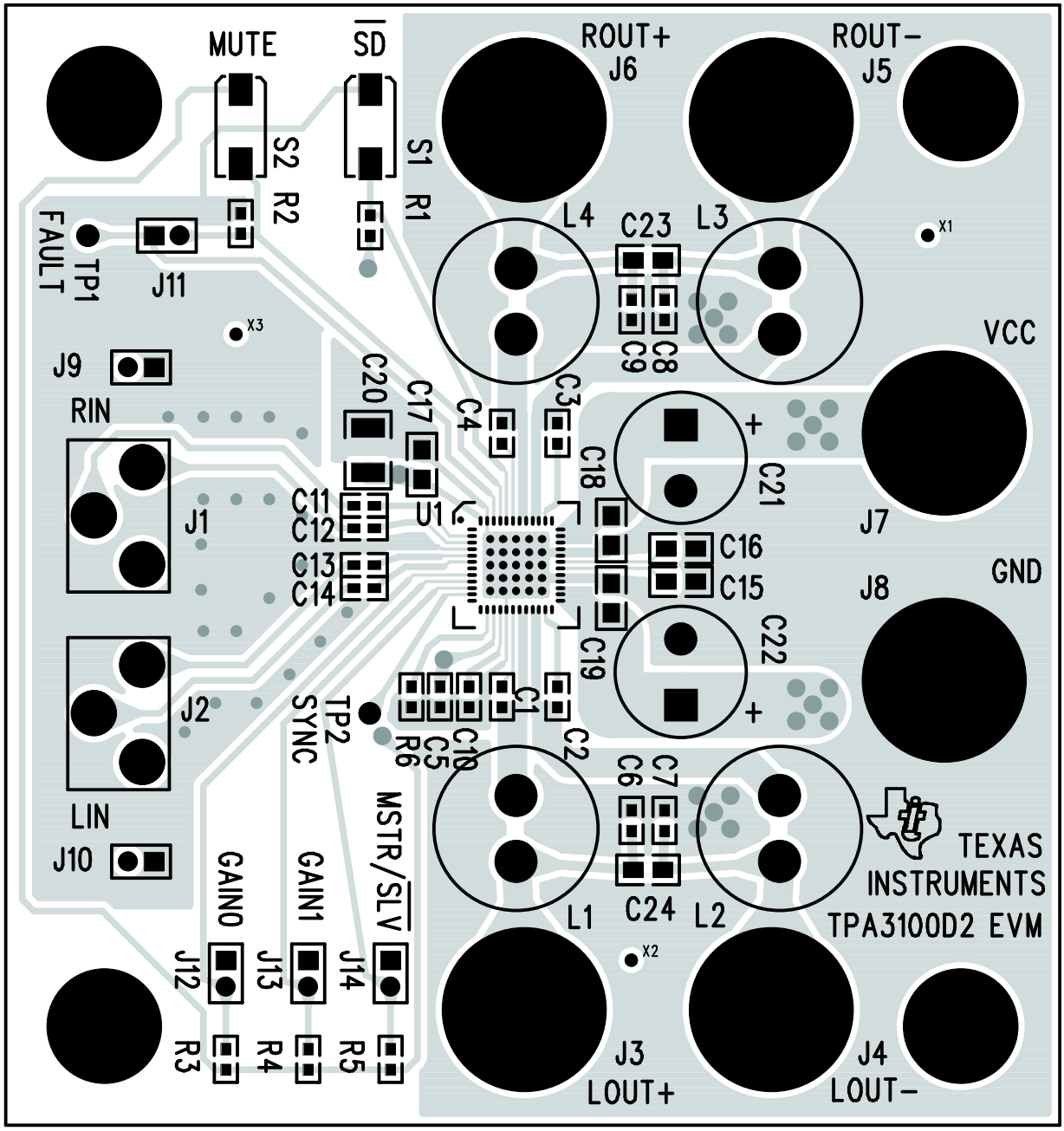

Figure 4. TPA3100D2 EVM – Top Layer

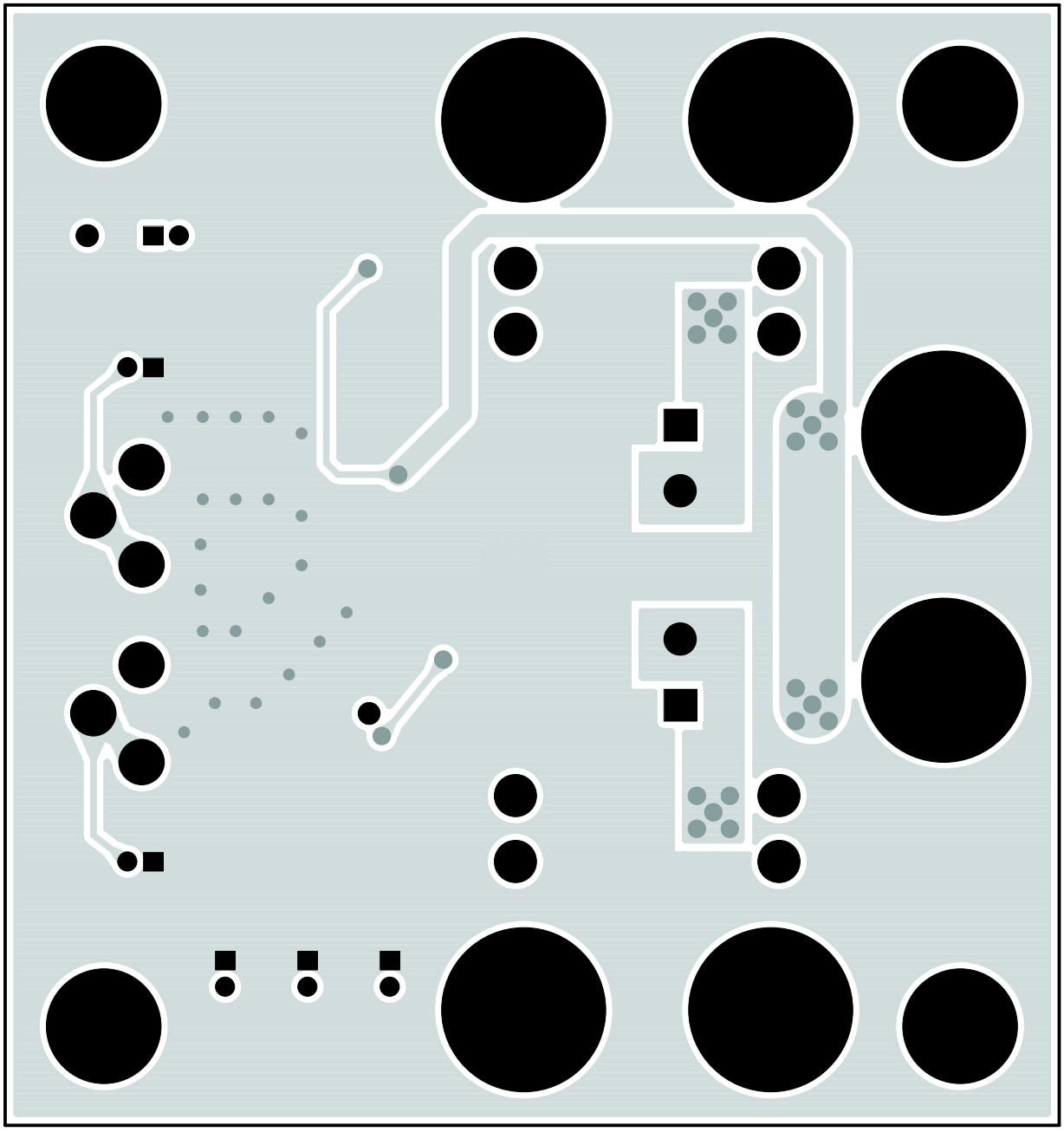

Figure 5. TPA3100D2 EVM – Bottom Layer

5 TPA3100D2 EVM Parts List

Table 2. TPA3100D2 EVM Parts List

Ref.	Description	Size	Qty	Mfg	Part #	Vendor #
C1 – C4	Capacitor, ceramic, 0.22-µF, ±10%, X7R, 25-V	0603	4	TDK	C1608X7R1C224KT	Digi-key/445-1318-2
C5	Capacitor, ceramic, 0.01-µF, ±10%, X7R, 50-V	0603	1	TDK	C1608X7R1H103KT	Digi-key/445-1311-2
C6 – C9	Capacitor, ceramic, 0.1-µF, ±10%, X7R, 50-V	0603	4	TDK	C1608X7R1H104KT	Digi-key/445-1314-2
C10 – C14	Capacitor, ceramic, 1.0-µF, ±10%, X5R, 10-V	0603	5	TDK	C1608X5R1A105KT	Digi-key/445-1321-2
C17 – C19	Capacitor, ceramic, 1.0-µF, +80%/–20%, Y5V, 50-V	0805	3	TDK	C2012Y5V1H105Z	Digi-key/445-1364-2
C15, C16	Capacitor, ceramic, 1.0-µF, +80%/–20%, Y5V, 16-V	0805	2	TDK	C2012Y5V1C105Z	Digi-key/445-1367-2
C20	Capacitor, ceramic, 10-µF, +80%/–20%, Y5V, 50-V	1210	1	Murata	GRM32DF51H106ZA01L	Digi-key/490-1891-2
C21, C22	Capacitor, electrolytic, 220-µF, low impedance	Radial	2	Panasonic	EEU-FC1V221	Digi-key/P10297
L1–L4	Inductor, 33-µH, radial lead, ferrite material, shielded	Radial	4	Toko	A7503AY-330M	
C23, C24	Capacitor, ceramic, 0.47-µF, ±10%, X5R, 35-V	0805	2	Taiyo-Yuden	GMK212BJ474KG	
R1 – R6	Resistor, chip, 100 kΩ, 1/16 W, 5%	0603	6	Panasonic	ERJ-3GEYJ104V	Digi-Key/P100KG
J1, J2	Phono jack, PC mount, switched		2	Switchcraft	PJRAN1X1U03	Newark/16C1860
J3 – J8	Banana jack w/knurled thumbnut (nickel plate)		6	Johnson	111-2223-001	Digi-Key/J587
J9 – J14	Header, 2 position, male	2 mm	6	Norcomp	2163-36-01-P2	Digi-Key / 2163S-36
J9 – J14(shunts)	Shunt, 2 mm	2 mm	6	Specialty	2JM-G	
TP1, TP2	Test points, 0.040" mounting hole		1	Farnell	240-345	
S1, S2	Switch, momentary, SMD, low profile		2	Panasonic	EVQ-PPBA25	Digi-Key/P8086S
	Standoffs, 5/8" length, 4-40 thread		4	Keystone	1808	(Newark) 89F1934
	Screws, 4-40, .375		4			(Digi-Key) H781-ND
U1	TPA3100D2RGZ	48-pin QFN	1	TI	TPA3100D2RGZ	

FCC Warnings

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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It is important to operate this EVM within the supply voltage range of –0.3 V to 30 V and input voltage range of –0.3 V to 4.5 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

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During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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